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Original article

Bacterial and fungal flora in patients having both upper and lower respiratory tract secretions for more than two weeks

[1]Dr. Rajesh Gupta, [2]Dr. Sunil Kumar, [3]Dr. Nidhi Goel#, [4]Dr. Dishant Gulati*

[1]Professor, [2]Jr. Resident, [3]Professor, [4]Ex. Senior Resident
*Department of Respiratory Medicine, Microbiology# and General Medicine**
Pt. B.D. Sharma PGIMS, Rohtak-124001
Haryana (India)
Correspondence: Dr. Dishant Gulati

ABSTRACT

Introduction: Respiratory tract infections are common and perhaps the most frequently reported infections of human being. These infections are traditionally divided into upper respiratory tract infections and lower respiratory tract infections.

Aims and Objective: To study bacterial and fungal flora in patients who had both upper and lower respiratory tract secretions for more than two weeks and to find out any correlation exist in bacterial and fungal flora in patients with coexisting respiratory signs and symptoms.

Materials and Methods: The present prospective study was conducted in the Department of Respiratory Medicine in association with Department of Microbiology, Pt. B.D. Sharma P.G.I.M.S, Rohtak. A total of 100 patients were included in the study who had both upper and lower respiratory tract secretions for more than two weeks.

Results: Mean age of the study population was 50.19±15.62 years. There were 73(73%) males and 27(27%) females. A total of 22(22%) cases patients were suffering from Chronic obstructive pulmonary disease (COPD), 21(21%) had Carcinoma lung, 18(18%) had pneumonia, 11(11%) had pulmonary tuberculosis (PTB), 8(8%) had sepsis, 8(8%) had pneumothorax with old PTB, 5(5%) bronchiectasis, 5(5%) had hydropneumothorax and one percent each had lung abscess and haemoptysis. 44(44%) patients were found to be currently chronic smoker followed by 34(34%) who were Chronic ex smoker. A total of 17(17%) patients were non-smoker and 5(5%) had biomass fuel exposure. 18(18%) patients had positive family history of tuberculosis, 14(14%) patients had taken anti-tubercular treatment in the past. Mean weight of the patients were 50.54±11.34 kgs. Out of total 16(16%) cases, sputum CBNAAT was done and *myocobacterium tuberculosis* was detected in 8 (8%) cases which were rifampicin sensitive and in 8(8%) cases no *mycobacterium* was detected. Sputum for AFB (1&2) was positive in 11(11%) cases.

Conclusion: Gram negative bacilli were the predominant isolates of lower respiratory tract infection with *Pseudomonas aeruginosa* as the common isolate followed by *Klebsiella pneumoniae* and *Acinetobacter baumannii* respectively. Further our study concluded that the bacterial and fungal infections were more common in lung diseases such as COPD, carcinoma lung, pneumonia and tuberculosis. Immunocompromised patient has more bacterial and fungal infection.

Keywords: Bacterial, Fungal, Flora, Respiratory Tract Secretions

INTRODUCTION

Respiratory tract infections are common and traditionally divided into upper respiratory tract infections and lower respiratory tract infections (LRTIs). Since these infections are mostly mild, short-lasting and sometimes self-limiting, many infected individuals tend to ignore them.[1] Of total 3,941,000 deaths in the world, respiratory tract infection accounts for 34.60% deaths in the South-East Region.[2] In addition, LRTI is one of the leading causes of morbidity and mortality worldwide.

In developing countries, the situation is more complicated, and management is often difficult due to the problem associated with the identification of the etiological agents and the administration of an appropriate treatment in cases requiring antibiotic therapy.[3]

Respiratory tract infections (RTI) are a persistent and widely spreading public health problem and cause a great burden of disease

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worldwide. Especially in developing countries like India, RTIs, mainly pneumonia are the leading cause of death. A great variety of pathogens can cause RTIs, and viruses have been considered as the predominant pathogens.

In the past decade, several new viruses associated with RTIs such as *human Metapneumo virus*, novel strains of *coronaviruses*, *human Boca virus*, *WU polyoma virus* and *KI polyomavirus* have been discovered in human respiratory tract specimens. Among them, some have been identified to be causative pathogens of RTIs.[4] Fungi are ubiquitous plants devoid of chlorophyll and have to survive on decaying organic matter as parasites. Out of more than 100,000 odd species[5], only a few are of importance to human health. These include antibiotic producing species like *Penicillium*, aggressive human pathogens like *Histoplasma* or *Blastomyces* group or opportunistic invaders like *Aspergillus* or *Candida* species.[6]

Massive population growth, urban development, and climate change are also factors that have increased the prevalence of fungal infections in certain areas and are putting more people at risk of becoming infected with the fungi that is endemic to where they live. More recently, natural disasters such as tsunamis and hurricanes have also contributed to the changing epidemiology of fungal infections. Acute respiratory tract infection is a major cause of morbidity and mortality in developing and also developed countries. RTI is an infection of any part of respiratory tract or any related structures including para nasal sinuses, middle ear and pleural cavity. In the developing countries out of ten, seven deaths in less than 5 year children are due to RTI.[7]

Upper respiratory tract infection (URTI) or “the common cold” is a symptom complex usually caused by several families of virus; these are the *rhinovirus, coronavirus, para influenza, respiratory syncytial virus, adenovirus, human metapneumo virus* and *influenza*. Occasionally the *enterovirus* is implicated in summer. Recently, the newly discovered *bocavirus* has also been linked to URTI. The term “URTI” is probably a misnomer as it incorrectly implies an absence of lower respiratory tract symptoms. URTI occurs commonly in both children and adults and is a major cause of mild morbidity. URTIs have a high cost to society, being responsible for missed work and unnecessary medical care. Occasionally they have serious sequelae. Often regarded as trivial, URTIs do not receive serious attention in medical school curricula.[8]

Lower Respiratory Tract Infection (LRTI) is one of the leading causes of morbidity and mortality in both developed and developing countries including India.

Globally, community acquired respiratory tract infections account for a large proportion of antibiotic prescriptions and visit to family practitioners.[9] It has been found that in India acute respiratory tract infection is responsible for one million deaths. Also there is inadequate information from India on various lower respiratory tract bacterial pathogens and resistance pattern in hospital settings. Infection of lower respiratory tract are responsible for 6% of general practitioners consultations and from 4.4% of hospital admission.[10] One complication is the patient’s expectation & belief that such infections require antibiotic treatment. The patient’s desire influences a physician to prescribe even when doctors see no clinical indication. They also found that this desire may be for a prescription based medicine, not necessarily an antibiotic. A common reason for a prescription is the mistaken belief that antibiotics reduce re-attendance.

Sputum samples are frequently used to study airway inflammation in respiratory diseases and to perform microbiological investigations of respiratory infections. In comparison to bronchoalveolar lavage, sputum offers the advantage of being non-invasive to obtain and is more readily available and suitable for repeated samples. The use of an induction protocol can result in samples being obtained from over three quarters of normal and asthmatic subjects who cannot produce sputum spontaneously.On the basis of above mentioned literature, the present study was planned to study bacterial and fungal flora in patients who had both upper and lower respiratory tract secretions for more than two weeks and any correlation exist in bacterial and fungal flora in patients with coexisting respiratory signs and symptoms.

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MATERIALS AND METHODS

The present prospective study was conducted in the Department of Respiratory Medicine in association with Department of Microbiology, Pt. B.D. Sharma P.G.I.M.S, Rohtak after obtaining the ethical clearance from the institutional Ethical committee. Informed and written consent was taken from patients before including them in the study**.** A total of 100 patients were included in the study who had both upper and lower respiratory tract secretions for more than two weeks. Nasal swabs were used for pyogenic culture & sensitivity and fungus culture, sputum was used for pyogenic culture & sensitivity and fungus culture.

Inclusion criteria:

* Patients above 18 years of age.
* Patients who had both upper and lower respiratory tract secretions with coexisting respiratory signs and symptoms for more than two weeks.

Exclusion criteria:

* Patient not expectorating sputum even on induction.
* Patient who refused to give written consent

Sample collection

Before sample collection, patients were asked to gargle with plain water and thereafter sputum samples were taken after coughing.

1. Sputum and induced sputum samples were collected in sterile vials
2. Nasal swabs were packed in sterile test tubes

An early morning expectorated sputum or induced sputum was collected after giving proper instructions to the patients, in sterile containers from all patients included in the study. Samples were transported promptly within two hours to the microbiology department. Expectorated sputum was examined for bacterial and fungal pathogens. The quality of the expectorated sputum was assessed both by macroscopic and microscopic examination. Induced sputum was obtained by inhalation of 3% hypertonic saline for 15 minutes with an ultrasonic nebuliser. Any sample that was thin watery and with no purulent matter was considered unsuitable for further processing. Bartlett's scoring method was used for microscopic evaluation of the expectorated sputum.[11] Sputum was considered unsuitable if it had a final score of 0 or less. All unsuitable specimens were discarded and a repeat specimen was collected. If gram staining shows > 25 pus cells and < 10 epithelial cells/low power field, sample was considered adequate for culture.[12] The isolates which were identified as contaminants or commensals were excluded from the study. Two samples of the upper respiratory tract were obtained from all patients using a sterile nasal swab. The swabs were packed in a sterile test tube and sent to microbiology department for pyogenic culture & sensitivity and fungus culture. Each sample was processed including the identification of the microorganisms and their antimicrobial susceptibility testing was performed following standard operating procedures of our institute and in accordance with Clinical and laboratory standards Institute (CLSI) guidelines.[13] Sabouraud dextrose agar was used for fungal culturing; plates were incubated at 28◦C for 7 days. Identification of fungi was based on macroscopic and microscopic characteristics using standard mycological methods. Identification of fungi was based on macroscopic and microscopic characteristics using standard mycological methods. The growth of cream pasty opaque colonies >30 colonies on SDA slant is considered significant and confirmed by gram stain.

Transportation

About 5ml sputum sample and nasal swabs were transported to the Microbiology Department within two hours in sterile vials. Patients included in the study were selected from those who attended Out-Patient Department of Respiratory Medicine and indoor patients. A detailed history and complete clinical examination of patients included in study was done. All patients underwent primary tests like complete haemogram, absolute platelet count, liver function tests, kidney function test, serum HIV, HbsAg, HCV, Nasal swab for pyogenic culture & sensitivity and fungus culture, sputum for acid fast bacilli and sputum for pyogenic culture & sensitivity and fungus culture.

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STATISTICAL METHODS

SPSS v23 (IBM Corp.) was used for data analysis. Descriptive statistics were elaborated in the form of means/standard deviations and frequencies & percentages for categorical variables.

RESULTS

Mean age of the study population was 50.19±15.62 years with a range of 18-78 years. There were 73(73%) males and 27(27%) females. Majority of patients were labourer i.e. 34(34%) followed by housewife and farmer i.e. 19(19%) each. COPD was the most common diagnosis of the present study. A total of 22(22%) cases patients were suffering from Chronic obstructive pulmonary disease (COPD), 21(21%) had Carcinoma lung, 18(18%) had pneumonia, 11(11%) had pulmonary tuberculosis (PTB), 8(8%) had sepsis, 8(8%) had pneumothorax with old PTB, 5(5%) bronchiectasis, 5(5%) had hydropneumothorax and one percent each had lung abscess and haemoptysis.

In our study, 44(44%) patients were found to be currently chronic smoker followed by 34(34%) who were Chronic ex smoker. A total of 17(17%) patients were non-smoker and 5(5%) had biomass fuel exposure. 18(18%) patients had positive family history of tuberculosis, 14(14%) patients had taken anti-tubercular treatment in the past.

Mean weight of the patients were 50.54±11.34 kgs. Pallor was found in 47% cases, icterus in 6%, cyanosis in 1%, clubbing in 46%, lymphadenopathy in 3%, edema in 19% and JVP in 3% cases. Mean SpO2 (%) was 91.84±7.25, mean pulse rate was 101.05±17.56, mean systolic blood pressure was 107.78±17.72 and diastolic blood pressure was 79.06±10.17 mmHg.

Kidney function tests were carried out in all the patients which showed that mean serum urea was 40.93±25.12, serum creatinine 0.81±0.36 and serum uric acid 4.98±2.42. Similarly, liver function tests of all the patients showed mean SGOT 58.16±67.08, SGPT 63.63±96.51 and serum bilirubin 0.61±0.40. Viral markers tests of the patients showed that 4(4%) patients were positive for HbsAg test and one patient was found to be HIV positive. No patient was HCV positive in the present study.

Out of total 16(16%) cases, sputum CBNAAT was done and *myocobacterium tuberculosis* was detected in 8 (8%) cases which were rifampicin sensitive and in 8(8%) cases no *mycobacterium* was detected. Sputum for AFB (1&2) was positive in 11(11%) cases.

Table-1 Nasal swab pyogenic culture of the study population

Parameters	No. of cases	Percentage
Micrococcus sp.	18	18
Staphylococcus aureus	16	16
Coagulase negative *Staphylococcus aureus*	6	6
Enterobacter sp.	2	2
Diptheroid sp.	1	1
Klebsiella pneumoniae	1	1
Sterile	56	56

18(18%) samples had *Micrococcus* sp., 16(16%) had *Staphylococcus aureus*, 6(6%) had coagulase negative *Staphylococcus aureus*, 2(2%) had *Enterobacter* sp. and 1% each had *Diptheroid* sp. and *Klebsiella pneumoniae*. A total of 56(56%) cases were found to be sterile.

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Table 2 Sputum for pyogenic culture of the study population

Parameters	No. of cases	Percentage
Pseudomonas aeruginosa	15	15
Acinetobacter baumannii	7	7
Klebsiella pneumoniae	7	7
Escherichia coli	4	4
Enterobacter	3	3
Staphylococcus aureus	1	1
Sterile	63	63

Out of 37(37%) sputum pyogenic positive samples, 15(15%) had *Psuedomonas aeruginosa*, 7(7%) had *Acinetobacter baumannii*, 7(7%) had *Klebsiella pneumonia*, 4(4%) had *Escherichia coli*, 3(3%) had *Enterobacter* and 1(1%) had *Staphylococcus aureus*. A total of 63(63%) sputum samples were sterile.

Table 3 Nasal swab for fungus culture of the study population

Parameters	No. of cases	Percentage
Candida sp.	7	7
Aspergillus flavus	2	2
Aspergillus fumigatus	2	2
Candida non *albicans*	2	2
Geotrichum sp.	1	1
Sterile	86	86

Out of 14(14%) positive nasal swab for fungus, *Candida* sp. was found in 7(7%) cases, *Aspergillus flavus*, *Aspergillus fumigatus* and *Candida non albicans* were found in 2(2%) cases each, respectively. *Geotrichum* sp. was found in 1(1%) only. A total 86(86%) of nasal swab were sterile for fungus culture.

Table 4 Sputum for fungal culture of the study population

Parameters	No. of cases	Percentage
Candia sp.	10	10
Aspergillus fumigatus	6	6
Aspergillus flavus	2	2
Aspergillus nidulans	2	2
Alternaria alternate	1	1
Apophysomyces elegans	1	1
Aspergillus clavatus	1	1
Aspergillus niger	1	1
Penicillium casei	1	1
Penicillium marneffei	1	1
Penicillium non-*marneffei*	1	1
Sterile	73	73

Out of 27(27%) of sputum positive samples, maximum 10(10%) cases had *Candida* sp. followed by 6(6%) cases with *Aspergillus fumigatus* followed by 2(2%) cases each of *Aspergillus flavus* and *Aspergillus nidulans* and 1(1%) each of *Alternaria alternate, Apophysomyces elegans, Aspergillus clavatus, Aspergillus niger, Penicillium casei, Penicillium marneffei* and *Penicillium non marneffei* respectively. A total 73(73%) of the sputum samples were sterile.

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DISCUSSION

A total of 100 samples were collected from both inpatients and out patients, of all age groups and both sexes diagnosed provisionally as having both upper and lower respiratory tract secretions for more than two weeks.

Upper and lower airways are always exposed to inhaled particulate materials that include pollens, viruses, bacterial and fungal spores. Microorganisms larger than 10µm are trapped by nasal hair and cilia lining the epithelium. Coughing and sneezing are the reflexes that expel the microorganisms from mouth and nose respectively. Most of the infections of respiratory tract are limited to upper tract and only 5% reaches the lower respiratory tract.[14]

Microorganism from the anterior nares can be trapped in the flowing mucus blanket covering the nasal mucosa deeper in the nose and therefore never reach the lungs. Aspiration of pharyngeal secretions occurs frequently in patients with depressed sensorium and also in normal adults during deep sleep. Bacterial pneumonia may result when aspirated bacteria are not effectively cleared. This may result when clearance mechanisms are impaired or when they are overwhelmed by large volumes of aspirated secretions. Infections in the LRT usually occur when the infecting organisms reach the lower airways or pulmonary parenchyma bypassing the mechanical and other non specific barriers of the upper respiratory tract.

The fungal infections of upper and lower respiratory tract represent one disease, “united fungal airway disease,” as they both depend on the same multiple factors such as exposure levels, anatomy, mucociliary clearance, mucosal health, and host immune factors.

Several authors have documented *Candida species* as the most common fungal agent isolated from sputum of pulmonary tuberculosis patients, its significance has always been a matter of controversy due to the fact that up to 32.5% healthy people carry *Candida* in their throat. This can contaminate the sputum sample during collection.[15]

Mean age of the study population was 50.19±15.62 years with a range of 18-78 years. Sex distribution of the patients showed that males were more than females i.e. 73(73%) males and 27(27%) females. Majority of patients were labourer i.e. 34% followed by housewife and farmer i.e. 19% each. A total of 22(22%) patients were suffering from Chronic obstructive pulmonary disease (COPD), 21(21%) had carcinoma lung, 18(18%) had pneumonia,11(11%) had pulmonary tuberculosis (PTB), 8(8%) had sepsis, 8(8%) had pneumothorax with old PTB, 5(5%) had bronchiectasis, 5(5%) had hydropneumothorax and 1(1%) each had haemoptysis and lung abscess. A total of 44(44%) patients found to be currently chronic smoker followed by 34(34%) who were Chronic ex smoker. A total of 17(17%) patients were non-smoker and 5(5%) had biomass fuel exposure, 18(18%) patients had positive family history of tuberculosis. A total of 14(14%) patients had taken anti-tubercular treatment in the past. Viral markers of the patients showed that 4 patients were positive for HbsAg test and one patient was HIV positive. No patient was HCV positive in the present study. Out of 100 cases studied, sputum for AFB (1&2) was positive in 11(11%) cases.

BACTERIA IN NASAL SWAB

Out of 100 a total of 44(44%) of nasal swab were positive for pyogenic organisms. The patients showed that 18(18%) samples had *Micrococcus* sp., 16(16%) had *Staphylococcus aureus*, 6(6%) had Coagulase negative *staphylococcus aureus*, 2(2%) had *Enterobacter* sp. and 1(1%) each had *Diptheroid* sp. and *Klebsiella pneumoniae*. A total of 56(56%) cases were found to be sterile.

In our study *Micrococcus* was found in 6 cases of carcinoma lung, 6 cases of pneumonia, 3 cases of pulmonary tuberculosis and one case each in COPD, hydropneumothorax and bronchiectasis. *Staphylococcus aureus* was found in 5 cases of carcinoma lung, 4 cases of pulmonary tuberculosis, 3 cases of COPD, 2 cases of old case pulmonary tuberculosis with pneumothorax and one case each in sepsis & bronchiectasis. Coagulase negative

staphylococcus aureus was found in 2 cases each of pneumonia and pulmonary tuberculosis and one case each in carcinoma lung & old case pulmonary tuberculosis with pneumothorax. *Enterobacter* was found in one case each of COPD & old case pulmonary tuberculosis with pneumothorax.

Savolainen et al examined 194 nasal cavities of 97 young healthy persons and showed that all had aerobic bacteria. However, only 76.5% nasal cavities had anaerobic bacteria. They showed that most common aerobic bacteria found was *Staphylococcus epidermidis* in 79% cases, whereas *Diphtheroids* were on second number (in 41% cases) and *Staphylococcus* aureus on third number (in 34% cases). They also found *Haemophilus influenzae* in 5% cases and *Streptococcus pneumoniae* in 0.5% case. The anaerobic bacteria found were *Propionibacterium acnes* in 74.5% cases and *Peptococcus magnus* in 3.5% cases. [16]

Beil et al (1998) endoscopically collected samples at the time of surgery in 174 CRS (chronic-rhinosinusitis) patients. The most commonly cultured bacteria were coagulase-negative *staphylococci* (36%), followed by *Staphylococcus aureus* (25%), *Streptococcus viridans* (8.3%), *Corynebacterium* (4.6%), and *anaerobes* (6.4%).[17]

BACTERIA IN SPUTUM

Out of 100 a total of 37(37%) sputum samples were positive for pyogenic organisms. A total of 15(15%) cases were found to be *Psuedomonas aeruginosa*, 7(7%) had *Acinetobacter baumannii*, 7(7%) had *Klebsiella pneumoniae*, 4(4%) *Escherichia coli*, 3(3%) *Enterobacter* and 1(1%) had *Staphylococcus aureus*. A total of 63(63%) sputum samples were sterile.

In our study *Pseudomonas aeruginosa* was found in 4 cases of bronchiectasis, 3 cases each of COPD & carcinoma lung, 2 cases each of hydropneumothorax & old case pulmonary tuberculosis with pneumothorax and one case was seen in sepsis.*Acinetobacter baumannii* was found in 2 cases each of carcinoma lung & pulmonary tuberculosis and one case each was seen in COPD, Pneumonia and sepsis.*Klebsiella pneumoniae* was found in 5 cases of pneumonia and one case each in COPD & pulmonary tuberculosis. *Escherichia coli* was found in 2 cases of carcinoma lung and one case each in COPD & sepsis. *Enterobacter* was found each in COPD, pneumonia and carcinoma lung. *Staphylococcus aureus* was found in COPD case.

Kumar et al (2019) showed that out of 60 cases of pulmonary TB, 39(65%) were sputum culture positive for various pyogenic organisms. Out of 39 positive cases most common organism isolated were *Staphylococcus aureus* 19(31.6%), *Klebsiella* 7(11.6%), *Pseudomonas* 7(11.6%), *Pneumococcus* 4(6.6%) and *Proteus* in 2(3.3 %) cases.[18] Madhavi et al (2015) showed that out of 81 COPD patients, the commonest isolate were *Klebsiella pneumoniae* 26 (59%) followed by *Pseudomonas aeruginosa* 7 (15%), *Staphylococcus aureus* 6 (13.6%), *Streptococcus pneumoniae* 3 (6.8%) and *Streptococcus pyogenes* 2 (4.5%).[19]

FUNGUS IN NASAL SWAB

Out of 100 a total of 14(14%) nasal swab were positive for fungus. *Candida* sp. was found in 7(7%) cases, *Aspergillus flavus*, *Aspergillus fumigatus* and *Candida non albicans* were found in 2(2%) cases each, respectively. *Geotrichum* sp. was found in 1(1%) case only.

In our study *candida sp* was seen in 3 case of COPD, 2 case of pneumonia and one case each of pulmonary tuberculosis & sepsis.*Aspergillus flavus* was seen in 2 cases of pneumonia. *Aspergillus fumigatus* was seen in pneumonia & sepsis each.*Candida non-albicans* was seen in COPD and carcinoma lung each.*Geotrichum sp* was seen in pneumonia.

The fungus *Aspergillus* can be found worldwide, with preferential tropism for humid soil. Although numerous species have been reported, few are pathogenic and *Aspergillus fumigatus* accounts for 90% of human infections. Due to the high sporulating capacity of *Aspergillus*, normal air contains a concentration ranging 1–100 spores/m-3. As the conidia released in the air after *Aspergillus* sporulation are small enough (2–3 mm diameter) to reach the alveoli, the lung is the main organ to be affected by *Aspergillus*.

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Arabi Mianroodi et al (2011) conducted a cross sectional study. Nasal swabs were used to sample the nasal cavity of 100 adults, study included 46 men and 54 women between 17 and 60 years age group, living in Kerman, Iran. Among 100 healthy people, one or more types of fungi were detected in 31 (31%) persons; *Candida* in 12(12%) persons, *Aspergillus* in 8(8%) persons, *Streptomyces* in 8(8%) persons, and *Penicillium*, *Nocardia* and *Mucor* in 1(1%) persons. In only 4 persons, more than one type of fungi was detected. There was no significant relation between age, sex, education or smoking with the presence of fungi.[20]

Hashemian et al (2012) did prospective cross-sectional study in 62 patients with a diagnosis of CRS. The fungal cultures were positive in 16 out of 62 patients with CRS (25.8%). In order of frequency the fungal genera and species were: *Aspergillus fumigatus* (9), *Aspergillus niger* (3), *Candida albicans* (2), *Penicillium* sp. (1) and *Cladosporium* sp. (1).[21]

FUNGUS IN SPUTUM

Out of 100 a total of 27(27%) sputum samples were positive for fungus, maximum 10(10%) cases had *Candida* sp., 6(6%) cases had *Aspergillus fumigatus* followed by 2(2%) cases each of *Aspergillus flavus* and *Aspergillus nidulans* and 1(1%) each of *Alternaria alternate*, *Apophysomyces elegans*, *Aspergillus clavatus*, *Aspergillus niger*, *Penicillium casei*, *Penicillium marneffei* and *Penicillium non marneffei* respectively. A total 73(73%) of the sputum samples were sterile.

In our study *Candida sp* was seen in 3 cases of old case pulmonary tuberculosis with pneumothorax and one case each in COPD, carcinoma lung, pneumonia, sepsis, haemoptysis, hydropnemothorax and bronchiectasis. *Aspergillus fumigatus* was seen in 2 cases each of COPD, sepsis and bronchiectasis. *Aspergillus flavus* was seen in one case of pneumonia and bronchiectasis. *Aspergillus nidulans* was seen in 2 case of pneumonia. *Alternaria alternate* was seen in one case of sepsis, *apophysomyces elegans* was seen in one case of carcinoma lung, *Aspergillus clavatus* was seen in one case of carcinoma lung, *Penicillium casei* was seen in one case of bronchiectasis, *Penicillium marneffi* was seen in one case of pulmonary tuberculosis and *Penicilliun non-marneffi* was seen in old case of pulmonary tuberculosis with pneumothorax.

Nagy et al 2019 also showed that out of 73 LRTI+ with lung carcinoma had *Candida albicans* in 19(26%) cases.[22] Nandihal et al 2018 showed that out of the total 100 patients with pulmonary tuberculosis, *Candida* co-infection was observed in 32 (32%) of patients. There was a significant male preponderance for *Candida* co-infection.[23]

Kali et al (2013) also showed that out of 75 diagnosed pulmonary tuberculosis patients *Candida* co-infection was observed in 30(40%) patients.[24]

CONCLUSION

Present study concluded that the bacterial and fungal infections were more common in lung diseases such as COPD, carcinoma lung, pneumonia and tuberculosis. Immunocompromised patient has more bacterial and fungal infection. In previous studies it was established that fungal infections are more common in America and Latin America but from this study it can be concluded that fungal infections are not that uncommon in our part of the world. Females have less prevalence of fungal infections as compare to males probably due to less exposure to external environment and estrogenic inhibition of fungal growth.

In COPD patients bacteria and fungus has been seen more probably due to distortion of lung texture and due to usage of steroid inhalers. Also in lung cancer and tuberculosis patient is in immunocompromised state and is more prone to bacterial and fungal infections. Fungal infection is very common in lower respiratory tract infections but it is often underdiagnosed and undertreated. The list of fungi affecting humans is very long so it is difficult to have a rapid test for each fungus hence it is mandatory to take respiratory samples for fungus culture.

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REFERENCES

1. Ndip RN, Ntiege EA, Ndip LM, Nkwelang G, Aoachere JF, Akenji TN. Antimicrobial resistance of bacterial agents of the upper respiratory tract of school children in Buea, Cameroon. J Health Popul Nutr 2008;26:397-404.
2. World Health organization. Leading causes of deaths in the SEA Regionand the World. Health situation in the South-East Asia Region 1998-2000. New Delhi. India: WHO, 2002.
3. Murray CJL, Lopez AD. Mortality by cause for eight regions of the world: global burden of disease study. Lancet 1997;349:1269-76.
4. He Y, Lin GY, Wang Q, Cai XY, Zhang YH, Lin CX et al. A 3-year prospective study of the epidemiology of acute respiratory viral infections in hospitalized children in Shenzhen, China. Influenza and Other Respiratory Viruses 2014;8:443-51.
5. The World Book Encyclopedia of Science (The Plant World Book). A World Book Inc, Chicago. 1994; 28-9.
6. Mohapatra LN, Pande JN. Pulmonary Mycotic Infections. In: Ahuja MMS, ed. Progress in Clinical Medicine in India, Heinemann A. New Delhi 1978; 235- 9.
7. Prajapati B, Talsania N, Sonaliya KN. A study on prevalence of acute respiratory tract infections (ARI) in under five children in urban and rural communities of Ahmedabad district, Gujarat. Nat J Comm Med 2011;2:255-9.
8. Cotton MF, Innes S, Jaspan H, Madide A, Rabie H. Management of upper respiratory tract infections in children, South Afr Fam Pract 2008;50:6-12.
9. Bariffi F, Sanduzz A, Ponticiello A. Epidemiology of lower respiratory tract infections. J Chemother 1995;7:263-76.
10. HSR Hosker, GM Jones, P Hawley. Fortnightly Review: Management of community acquired lower respiratory tract infections. Br Med J 1994;308:701-75
11. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC Jr. The role of Microbiology laboratory in the diagnosis of infectious disease: Guidelines to practice and management. In: Color atlas and text book of diagnostic microbiology, 5 th edition. Lippincott, Philadelphia, New York (Pubs.) 1997:69.
12. Chawla K, Mukhopadhay C, Majumdar M, Bairy I. Bacteriological profile and their antibiogram from cases of acute exacerbations of chronic obstructive pulmonary disease: A Hospital Based Study 2008.2;1:612-6.
13. Collee JG, Miles RS, Watt B. Tests for identification of bacteria. In: Collee JG, Fraser AG, Marmion BP, Simmons A. eds. Mackie and McCartney's Practical medical microbiology, 14th ed. Churchill Livingstone, 2006.
14. Prescott LM, Harley JR, Klein DA. Microbiology, 6th edn., McGraw-Hill. Higher Education, Boston Burride, 2005.p.673-936.
15. Santiwongkarn P, Kachonboon S, Thanyasrisung P, Matangkasombut O. Prevalence of oral Candida carriage in Thai adolescents. J Investig Clin Dent 2012;3:51-5.
16. Savolainen S, Ylikoski J, Jousimies-Somer H. The bacterial flora of the nasal cavity in healthy young men. Rhinology 1986;24:249-55.
17. Biel MA, Brown CA, Levinson RM, Garvis GE, Paisner HM, Sigel ME, et al. Evaluation of the microbiology of chronic maxillary sinusitis. Annal Otol, Rhinol Laryngol 1998;107:942-5.
18. Su J, Liu HY, Tan XI, Yong JI, Jiang YX, Prabhakar M, et al. Sputum bacterial and fungal dynamics during exacerbations of severe COPD. Plos One 2015;10:1-13.
19. Masavkar SP, Naikwadi AM. Study of incidence of upper respiratory tract infections in urban and rural population. Sch J App Med Sci 2016;4:2023-6.
20. Arabi-Mianroodi A. The fungi flora of healthy nasal mucosa in Kerman, Iran. Iranian J Otorhinolaryngol 2011;23:63.

21. Hashemian F. The prevalence of positive fungal cultures in patients with chronic rhinosinusitis in a high altitude region of Iran. Iranian J Otorhinolaryngol 2012;24:66.
22. Nagy A, Muller V, Kolonics-Farkas AM, Eszes N, Vincze K, Harvath G. Worse lung cancer outcome in patients with lower respiratory tract infection confirmed at time of diagnosis. Thoracic Cancer 2019;10:1819-26.
23. Nandihal NW, Bharathi R, Divya A. Prevalence of different species of candida in sputum of pulmonary tuberculosis. Int J Curr Microbiol App Sci 2018;7:3072-5.
24. Tutar N, Metan G, Koc AN, Vilmaz I, Bozkurt I, Simsek ZO, et al. Invasive pulmonary aspergillosis in patients with chronic obstructive pulmonary disease. Multidisp Respir Med 2013;8:59-66.